

REMARKS

Claims 1-3 and 8-16 are presently pending in the application.

Claims 5 and 6 have been cancelled and their subject matter has been incorporated in amended claim 1. Accordingly, no new matter has been added, and entry of the amendments is respectfully requested.

The Examiner has rejected all of the claims under 35 U.S.C. § 103(a) as being unpatentable over DE 30 21 949 (DE '949) in view of French Patent Publication 2,122,758, U.S. Patent 3,752,753 of Fitterer or U.S. Patent 4,105,507 of Von Krusenstierna et al. (VK) and U.S. Patent 4,390, 406 of Kato, or this combination further in view of additional references for some of the dependent claims. In particular, for claims 5 and 6, which are now incorporated in claim 1, the Examiner adds U.S. Patent 3,755,125 of Shaw et al. or U.S. Patent 3,959,107 of Horner et al. Since all of the remaining claims in the application depend from this amended claim 1 incorporating claims 5 and 6, it is the rejection of these claims which will be discussed below, together with the Examiner's additional arguments.

In response to the previous Office Action, Applicant argued that Kato's electrode is intended for use at room temperature, not the high temperature molten metal environment of DE '949, and that since a plastic might melt at these high temperatures, one of ordinary skill in the art would not use a plastic as the material of the cap in DE '949. In the present Office Action, the Examiner contends that this argument is not persuasive because the cap of the DE '949 electrode probe is at the electrical connection end and is not intended to be immersed in the molten metal, and thus would not be subjected to the high temperatures of a molten metal. The Examiner notes, for example, U.S. Patent 4,342,633 of Cure, which shows plastic elements 66, 68 at the electrical connection end of a probe. The Examiner also contends that the melting point of any plastic is well-documented in reference handbooks, and that one would merely pick a plastic that has a high melting point, if temperature degradation is a concern. These rejections and arguments in support thereof are respectfully but strenuously traversed for the reasons set forth in detail below.

First, to clarify the record, it is noted that the Examiner believes that U.S. Patent 4,342,633 corresponds with DE '949 (see 4th paragraph of page 2 of the Office Action). That is

not the case. As set forth in the second full paragraph at page 5 of the response to the previous Office Action, Applicant stated that Cure U.S. Patent 4,342,633 is the U.S. counterpart of DE 28 42 136 A1.

Second, the electrical connection elements 66, 68 at the end of the probe are not the same as the closure 7 of the present invention and are not subjected to the same levels of temperature, as discussed more thoroughly in the accompanying Declaration of Jacques Plessers Under 37 C.F.R. § 1.132 ("Plessers Declaration").

The Plessers Declaration is submitted to correct the misconceptions of the Examiner in his arguments, particularly in the fourth and fifth paragraphs at page 2 of the Office Action. As explained in paragraph 4 of the Plessers Declaration, the immersion end of the solid electrolyte cell must withstand a temperature of about 1450 to 1730°C, while the back end of the cell with the plug or closure reaches a temperature of about 200 to 300°C. The electrical connector to the measuring head remains at about 20 to 40°C. Thus, while the Examiner is correct that the electrical connection end is not intended to be immersed in the molten metal and would not be subjected to the high temperature of a molten metal, the closure or back end of the cell still reaches temperatures of 200 to 300°C, which will melt many plastics. Therefore, as concluded by Mr. Plessers in paragraph 5 of his declaration, it would not have been obvious to one skilled in the art to seal the end of the solid electrolyte cell with a plastic which would degenerate, possibly contaminate the oxygen cell, and result in a measurement error.

However, contrary to the Examiner's assumption and argument, Applicants did not pick a plastic having a high melting point, but instead selected polypropylene, having a melting temperature of 160°C (well below the prevailing temperatures of about 200 to 300°C at the back or plug end of the cell). As noted in paragraph 6 of the Plessers Declaration, the inventors surprisingly found that a polypropylene cap or closure does not influence the measurement result and is completely dissolved upon withdrawal of the measuring probe from the melt. Therefore, as concluded by the Plessers Declaration, the Examiner's assumption and stated basis for his rejection at page 2 of the Office Action are without merit. That is, Applicants have not selected a plastic with a high melting point, but rather polypropylene which melts below the temperatures reached at the back end of the electrolyte cell.

The Examiner relies on U.S. Patent 3,755,125 of Shaw or 3,959,107 of Horner for the disclosure of the use of a polyolefin, such as polypropylene. In rejecting claims 5 and 6 at page 6 of the Office Action dated July 3, 2003, the Examiner acknowledges that these claims (now part of claim 1) differ by calling for a cap (closure 7) to be made of a polyolefin, such as polypropylene. In particular, the Examiner contends that Shaw discloses polypropylene to be a well-known construction material for a probe component (column 3, line 5), and that Horner discloses an enclosure cap 44 in the form of a heat-shrinkable sleeve (Fig. 1 and column 6, lines 53-55). The Examiner notes that heat-shrinkable sleeves are often made of a polyolefin. The Examiner concludes that it would have been obvious to make the cap or closure 7 of DE '949 of polypropylene, since it is inert, inexpensive, readily available and can be easily applied as a shrink tube to offer a good seal. These rejections and the arguments in support thereof are respectfully but strenuously traversed.

At page 3 of the Office Action, the Examiner contended that no separate argument has been presented for the rejection of claims 5 and 6. To the contrary, at the bottom of page 7 of Applicants' response to the previous Office Action, Applicant specifically pointed out that the Shaw and Horner references, like Kato, are directed to measuring electrodes or electrolytic cells which are used at room temperature or at least not in high temperature environments. Therefore, since there is no indication in either of these references that these devices would be usable in connection with probes for molten metals, the Examiner's attempt to combine these references with DE '949 and the other references used in the basic combination rejections of the Office Action is improper. That is, there is no motivation or suggestion to use a material from a room temperature or low temperature environment, particularly a relatively low melting material such as polypropylene, in a high temperature environment for measuring properties in molten metals. Further, as demonstrated in the enclosed Plessers Declaration, it was surprising that the inventors of the present application discovered the possibility of using a polypropylene cap or closure having a melting temperature of 160°C at the back of a solid electrolyte cell, where the temperatures during oxygen measurement in a metal or slag melt reach about 200 to 300°C.

Accordingly, the Examiner has failed to establish a prima facie case of obviousness, for the reasons stated in response to the first Office Action and repeated above. Further, in view of the facts presented in the Plessers Declaration regarding the various temperature ranges around

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the solid electrolyte cell, the assumptions upon which the Examiner based his rejection are shown to be incorrect. Moreover, the use of polypropylene for the closure 7 in the presently claimed invention has been shown to be unexpected and therefore unobvious to one skilled in the art at the time of the invention.

Accordingly, in view of the above Amendments and Remarks, reconsideration and withdrawal of the rejections and an early Notice of Allowance are respectfully solicited.

Respectfully submitted,
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Enclosures – RCE Request
Petition for Extension of Time (one month)
Declaration of Jacques Plessers Under 37 C.F.R. § 1.132
Supplemental Information Disclosure Statement